Trace Metals in Marine Organisms from Coastal Waters of Southern British Columbia (1971 to 1976)

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TRACE METALS IN MARINE ORGANISMS FROM COASTAL WATERS OF SOUTHERN BRITISH COLUMBIA (1971 to 1976)

by

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ABSTRACT

R.M. Harbo, I.K. Birtwell and O.E. Langer. 1983. Trace metals in marine organisms from coastal waters of southern British Columbia, 1971 to 1976, Canadian Manuscript Report of Fisheries and Aquatic Sciences 1691: 42p.

Trace metal concentrations were determined in a variety of marine organisms from southern coastal waters of British Columbia. This report lists data for samples collected between 1971 and 1973, and in 1976 from waters adjacent to urban and industrial areas.

The levels of mercury, copper, zinc, lead, cadmium, nickel, arsenic and iron in tissue samples have been summarized for selected edible molluscs, crustaceans and fishes. Results are expressed on a dry and wet weight basis.

Spiny dogfish, *Squalus acanthias*, had the highest mercury content of 1.01 ± 0.47 µg g^{-1} (wet weight).

Pacific oysters, *Crassostrea gigas*, had a high mean zinc level of 647 ± 927 ug g^{-1} (wet weight). The concentration of cadmium in *C. gigas* was also much higher than that found in other shellfish; 1.37 ± 0.50 µg g^{-1} (wet weight).

Key Words: trace metals, fishes, crustaceans, molluscs, British Columbia, marine organisms, mercury, cadmium, copper, zinc, iron, arsenic, lead.

RÉSUMÉ

Le présent rapport porte sur les concentrations de métaux-traces dans divers organismes marins provenant des eaux côtières méridionales de la Colombie-Britannique. Sont répertoriées les données sur des échantillons prélevés de 1971 a 1973 et en 1976 dans les eaux adjacentes à des zones urbaines et industrielles.

Les taux de mercure, de cuivre, de zinc, de plomb, de cadmium, de nickel, d'arsenique et de fer dans les échantillons de tissus sont résumés pour certains mollusques, crustacés et poissons. Les résultats sont exprimés en poids sec et en poids humide.

L'aiguillat commun, *Squalus acanthias*, contient le taux le plus élevé de mercure, soit un poids humide moyen de $1,01 \pm 0,47$ ug g^{-1} (d.s.).

L'huître du Pacifique, *Crassostrea gigas* possede un taux moyen élevé de zinc (poids humide) de 647 ± 927 ug g^{-1}. Les concentrations de cadmium ($1,37 \pm 0,50$ ug g^{-1}) dans cette espèce est aussi plus élevée que chez les autres mollusques et crustacés.

Mots-clés: métaux-traces, poissons, crustacés, mollusques, Colombie-Britannique, organismes marins, mercure, cadmium, cuivre, zinc, fer, arsenique, plomb.

INTRODUCTION

When mercury contamination of aquatic organisms in Canada was discovered in 1969 and 1970, attention was also focused upon contamination by other heavy metals. This report lists metal content data for marine organisms collected by the Water Quality Unit, Habitat Protection Division, Department of Fisheries and Oceans, between 1971 and 1973 with additional information from surveys carried out in 1976.

Marine organisms collected from waters adjacent to urban and industrial areas in southern British Columbia were analyzed for the following metals: mercury, copper, zinc, lead, cadmium, nickel, iron and arsenic.

There has been great concern that metals and their compounds entering the marine environment may be accumulating in fishes and other edible organisms at levels constituting a hazard to human health. In addition, there may be lethal and sublethal effects of metals on marine organisms (Bernhard and Zahtera 1975).

Mercury is considered to be the most hazardous metal to man and marine organisms (Bernhard and Zahtera 1975). In Japan, consumption of mercury contaminated fish resulted in severe neurological disorders and death in humans (Bligh 1972). Mercury contamination in Canada resulted in the closure or restriction of fishing in many parts of the country.

Consumption of fish contaminated with cadmium was also a health problem in Japan, causing an affliction known as "Itai itai" (Ui 1972). People have been ill from cadmium poisoning after ingesting foods containing concentrations of 13 to 15 $\mu g\ g^{-1}$ (dry weight) (Zaroogian and Cheer 1976).

Lead in fish may also pose a hazard to human health. Zinc and copper levels in aquatic organisms are not considered hazardous to humans but the metals may have lethal or sublethal effects on the organisms themselves (Bernhard and Zahtera 1975).

The means by which metals enter the aquatic environment include direct discharges to waters, movement through soils, and transport through the air with subsequent fallout.

Potential sources of metal pollution in British Columbia include mining waste discharges, effluents from electro-plating industries, municipal wastewater discharges, mercury-cell chlor-alkali plants, and numerous other industrial processes and applications.

Federal regulations and guidelines have been implemented under the Federal Fisheries Act to limit the entry of metals into the aquatic environment; Metal Mining Liquid Effluent Regulations and Guidelines (1977), Guidelines for the Control of Liquid Effluents from Metal Finishing Plants (1978), and Chlor-Alkali Mercury Regulations (1972). Metals released to the aquatic environment are regulated under the Ocean Dumping Control Act (1975) and will also be scheduled in the Environmental Contaminants Act (1976).

Mercury used by the chlor-alkali industry, agricultural and mining wastes, and mercurial slimicides used by the pulp and paper industry are considered to be the main sources of mercury pollution in British Columbia. Garret (1980) presents an overview of mercury pollution in British Columbia and the Yukon. Mercury contamination of marine organisms in Howe Sound, British Columbia, the site of a mercury-cell chlor-alkali plant, is described by Harbo and Birtwell (1978).

A significant source of zinc contamination in certain coastal areas of British Columbia has been related to the pulp and paper industry (Nelson and Goyette 1976). At the time of the collection of most organisms in this study (1971 and 1973), many B.C. pulp mills used the bleaching compound, zinc hydrosulphite, in the production of newsprint. However, by September 1974, this compound was replaced by sodium hydrosulphite at most mills (Nelson and Goyette 1976) and is currently in use at all mills on the southern B.C. coast (memoranda, Environmental Protection Service, Department of the Environment 1973). Smelting in B.C. is also a main source of zinc and lead pollution.

This report was prepared to provide baseline metal data for marine biota from coastal waters of southern British Columbia and to identify any metal contamination problems in organisms within specific areas.

MATERIALS AND METHODS

COLLECTION OF SAMPLES AND SAMPLE PREPARATION

Sampling Sites and Times

The locations of sampling sites are shown in Figure 1.

Most fish and invertebrate samples (molluscs, crustaceans, echinoderms) were collected between 1971 and 1973, at sites in coastal waters of southern British Columbia adjacent to urban and industrial areas (Figure 1).

Samples were also taken in 1976 in waters adjacent to Texada Island (site 9), Cortes Island (site 5) and in Cowichan Bay (site 18).

Sample Techniques

Organisms were collected using various techniques including crab and prawn trap, gillnets, beach seines and by scuba diving.

Sample Preparation

All samples were frozen as soon as possible after collection. A chest of dry ice was used aboard the sampling vessel.

Fishes: Samples of dorsal muscle tissue were taken posterior to the head of the fish, a standard procedure for sampling tissues to determine their mercury content (Johnels et al. 1967). Skin was removed from the samples before submitting tissues to the laboratory.

The fork lengths of some fish were recorded.

At site 2, in 1971, aggregates of two yellow-eye rockfish tissue samples were each analyzed for metal content.

Other Samples: Various tissue samples were taken from other organisms which are listed in Table 1.

Carapace widths of some crabs were recorded. Crab and shrimp tissues were taken from the shell, and the edible tissue submitted to the laboratory for analysis.

LABORATORY ANALYSES

At the time of these surveys, metal detection in tissues was a relatively new procedure. Different methods of preparation and concentration were used over the period covered by this report. However, these changes were more in the nature of improved efficiency and increased ability to analyze more elements. The laboratory considers that the different methods of preparation have not affected the results.

Lead, Nickel, Cadmium, Copper, Arsenic and Iron

Preservation: All samples were frozen until preparation.

Preparation: All samples were blended and/or ground before and/or after drying. Most samples were oven dried in acid washed evaporating dishes at 60^{0} C; other samples were freeze dried.

Digestion: Samples were digested with hot nitric acid, or were oxidized in a Low Temperature Asher (LTA) using an oxygen bearing plasma and the ash dissolved in dilute nitric acid.

Concentration: The following liquid-liquid extraction techniques were utilized: Ammonium pymolidine dithiocarbamate (APDC) - 2 Heptanone was employed for lead, nickel, and cadmium extractions.
APDC - methyl-isobutylketone (MIBK) was also utilized for some lead extractions.

Extractions were not required for Cu, As and Fe.

Analysis: All metal concentrations were determined by Atomic Absorption Spectrophotometry (AAS). Each sample was analyzed by direct aspiration of the digested sample after liquid-liquid extraction. Various background corrections were used throughout.

Mercury Analyses

All mercury determinations were performed by the same basic method with slight procedural modification. The method was routinely compared with other methods by participation in an international check sample program instituted by the Winnipeg Fish Inspection Laboratory, now part of the Department of Fisheries and Oceans.

Preservation: All samples were frozen until preparation.

Preparation: The samples were blended and a portion of each sample was taken for mercury determination.

Digestion: The wet (or freeze dried) sample was digested in concentrated sulfuric acid and oxidized with 50% hydrogen peroxide. The solution was diluted and maintained in an oxidizing condition with a dilute potassium permangate solution. The mercury was then reduced by stannous sulfate or stannous chloride, swept by argon into an absorption cell situated in the beam path of an atomic absorption spectrophotometer. The absorbance was determined with simultaneous background correction. Dry weight concentrations were calculated from wet/dry ratios.

RESULTS AND DISCUSSIONS

A list of the organisms which were analyzed is given in Table 1. Analyses for metals were conducted on edible portions of the organisms, usually muscle tissue. However, it has been shown that metal values often differ in various body organs. For example, mercury is sometimes lower in fish organs than muscle tissues but other metals: arsenic, cadmium, copper, and zinc are often higher in kidney tissue (Windom et al. 1973).

Summaries of the means and ranges of trace metal concentrations are presented for selected edible species in Tables 2 and 3. The maximum values were given to data expressed as "less than" a value.

Table 4 lists the data for mercury, copper, zinc, lead, cadmium and nickel levels for all organisms sampled.

Only a few organisms (oysters, crabs and fishes) were tested for arsenic and iron content, and these data are shown in Table 5.

Table 6 lists the mercury, copper, zinc, lead, cadmium and nickel data for some marine organisms which were not identified to the species level.

Mercury results are frequently reported on wet-weight basis due to losses of mercury during many drying techniques. Other metals are reported on dry-weight basis, and a wet-weight concentraiton was calculated from the wet to dry ratio for the specific organism.

We have reported wet weight values for direct comparison to health standards (or recommended tolerance levels) in aquatic animal products which are specified for fresh (wet weight) tissues.

Most metal levels in biota are reported as dry weight concentrations because of the variable water content of most organisms. Accordingly we have reported dry weight values for direct comparison with reported levels in the literature.

MERCURY RESULTS (Table 2)

Molluscs

Mean levels of mercury in molluscs were less than 0.10 µg g^{-1}. Mercury content ranged from 0.01 to 0.23 µg g^{-1} (Table 2).

Crustaceans

Crustaceans contained mean mercury concentrations less than 0.20 µg g^{-1}. Dungeness crabs, *Cancer magister*, from the Fraser River estuary had mercury contents ranging from 0.06 to 0.59 µg g^{-1}.

Red rock crabs, *Cancer productus*, from Ucluelet harbour had mercury concentrations to 0.65 µg g^{-1}, higher than at any of the other sampling sites.

Fishes

Concentrations of mercury below 0.2 µg g^{-1} (wet weight) in fish are generally assumed to be due to naturally occurring mercury (Lofroth 1969).

Spiny dogfish, *Squalus acanthias*, were notable for their accumulation of mercury to mean levels greater than other species. *Squalus* contained mean mercury levels of 1.01 ±0.47 µg g^{-1} ($\bar{x}$ ± S.D., n = 22).

Forrester *et al.* (1972), reported similar results, and found that male *S. acanthias* longer than 72 cm and females longer than 77 cm from the Strait of Georgia, British Columbia had mercury concentrations which exceeded 0.5 µg g^{-1}. Since *S. acanthias* may live in excess of 40 years (Hart, 1973) the potential for mercury accumulation in an older, larger fish, even in waters of low mercury concentrations, would be greater than for shorter-lived fishes.

Rockfishes, *Sebastes* spp., exhibited mercury contents ranging from 0.05 to 1.02 µg g^{-1}, but had a mean value of 0.26 ± 0.26 µg g^{-1} ($\bar{x}$ ± S.D., n = 49).

COPPER RESULTS (Table 2)

Molluscs

Pacific oysters, *Crassostrea gigas*, had a mean copper concentration (wet weight) of 27.33 ± 45.94 µg g^{-1} ($\bar{x}$ ± S.D., n = 46) which ranged from 5.00 to 260 µg g^{-1}. The highest copper values were recorded in oysters from Discovery Passage, Campbell River.

All the other molluscs that were sampled contained a mean copper content less than 5 µg g^{-1} (wet weight) or 20 µg g^{-1} (dry weight).

Crustaceans

The copper content of all crustaceans sampled were similar, with mean levels being less than 10 µg g^{-1} (wet weight) or 50 µg g^{-1} (dry weight).

Fishes

Most fishes had relatively low copper contents, less than 2.0 µg g^{-1} (wet weight) or 10 µg g^{-1} (dry weight).

For selected edible species, the highest mean and range for copper concentrations in fish were recorded for coho salmon, *Oncorhynchus kisutch*, from Cowichan Bay. The mean content was 1.96 ± 1.92 ($\bar{x}$ ± S.D., n = 3), copper levels ranging from 0.50 to 7.00 µg wet weight.

A red Irish lord, *Hemilepidotus hemilepidotus* from Juan de Fuca Strait accumulated copper to 32 µg g^{-1} (wet weight) or 140 µg g^{-1} (dry weight) (Table 4).

The above levels are comparable to Atlantic fishes ($n \geq 5$) which had mean copper concentrations ranging from 1.6 to 10 µg g^{-1} dry weight reported by Windom et al.(1973).

ZINC RESULTS (Table 2)

Molluscs

The Pacific oyster, *Crassostrea gigas*, was notable for concentrating zinc to levels greater than those recorded in other shellfish.

The mean wet and dry weight zinc contents for *C. gigas* were 647 ± 927 µg and 2886 ± 4117 µg g^{-1} ($\bar{x}$ ± S.D., n = 46).

C. gigas from studies in the United States (Washington, Oregon and California) also had high zinc levels; mean values for 10 oysters ranged from 77 to 461 µg g^{-1} on a wet weight basis (Hall et al. 1978). Levels two orders of magnitude greater than those above were reported by Thrower and Eustace (1973). *C. gigas* from the Derwent estuary, Tasmania, had a maximum zinc content of 54,952 µg g^{-1} dry weight.

Watling and Watling (1976) reported zinc values in *C. gigas*: mean values recorded in the United Kingdom ranged from 189.6 µg g^{-1}

(n = 30) to 35,120 µg g^{-1} (n = 7) dry tissue, and in South Africa 347 µg g^{-1} (n = 10) to 450 µg g^{-1} (n = 50).

Other shellfish had mean zinc values less than 30 µg g^{-1} (wet weight) or 130 µg g^{-1} (dry weight).

Crustaceans

Important edible species of crabs and shrimps had mean zinc levels less than 60 µg g^{-1} (wet weight) or 260 µg g^{-1} (dry weight). For example, in the Dungeness crab, *Cancer magister*, mean zinc concentrations (wet and dry weights respectively) were 40.35 ± 10.00 µg g^{-1} and 195.21 ± 51.56 µg g^{-1} ($\bar{x}$ ± S.D., n = 70).

Fishes

Fish muscle tissues contained mean zinc levels less than 15 µg g^{-1} (wet weight) or 60 µg g^{-1} (dry weight).

Lingcod, *Ophiodon elongatus*, contained the highest mean zinc content (wet weight) of 12.45 ± 10.61 µg g^{-1} ($\bar{x}$ ± S.D., n = 17). Zinc levels in this species ranged from 1.30 to 41.00 µg g^{-1} (wet weight) or 4.90 to 190.00 µg g^{-1} (dry weight).

Windom *et al.* reported that Atlantic finfish generally had similar mean zinc levels, except for one species, *Anchoa mitchelli*, (n = 6), that had a mean concentration of 397 µg g^{-1} dry weight.

LEAD RESULTS (Table 3)

Molluscs

Mean lead levels were less than 0.70 µg g^{-1} (wet weight) or 4.5 µg g^{-1} (dry weight) for most molluscs. However, a high value of 5.40 µg g^{-1} (wet weight) or 27.80 µg g^{-1} (dry weight) was reported for an aggregate sample of clams from Hardy Bay, Port Hardy.

Crustaceans

The mean lead content of crustaceans was less than 0.60 µg g^{-1} (wet weight) or 2.0 µg g^{-1} (dry weight). Dungeness crabs, *Cancer magister*, had a mean lead level of 0.37 ± 0.20 ($\bar{x}$ ± S.D., n = 29) µg g^{-1} (wet weight) or 1.73 ± 1.00 µg g^{-1} (dry weight).

Fishes

The lead contents of fishes were similar to that of molluscs and crustaceans; the mean values were less than 0.60 µg g^{-1} (wet weight) or 2.5 µg g^{-1} (dry weight). Coho salmon had the greatest mean lead content of selected edible fishes; the mean (wet and dry weights respectively) was 0.53 ± 0.16 µg g^{-1} and 2.43 ± 0.94 µg g^{-1} ($\bar{x}$ ± S.D., n = 13).

CADMIUM RESULTS (Table 3)

Molluscs

Pacific oysters, *Crassostrea gigas*, were found to contain an elevated cadmium mean level relative to other shellfish. Mean wet and dry weight concentrations were 1.37 ± 0.50 µg g^{-1} and 5.95 ± 2.29 µg g^{-1} ($\bar{x}$ ± S.D., n = 42) respectively. The mean cadmium levels in other shellfish were less than 0.40 µg g^{-1} (wet weight) or 2.30 µg g^{-1} (dry weight).

Hall et al. (1978) found that in the Pacific Northwest U.S.A. (Washington, Oregon and California), *C. gigas* (n = 10) had mean cadmium values ranging from 0.640 to 158 µg g^{-1} wet weight. Shuster and Pringle (1969) found concentrations of 0.1 to 7.80 µg g^{-1} cadmium, (mean 3.10 µg g^{-1}) in whole wet meats of the American oyster, *C. virginica*, along the Atlantic coast of the U.S.A.

Crustaceans

The mean levels of cadmium in crustaceans ranged from 0.10 to 0.25 µg g^{-1} (wet weight), 0.51 to 1.25 µg g^{-1} (dry weight).

Fishes

Cadmium levels in all the fishes sampled were similar, and the mean cadmium content was less than 0.20 µg g^{-1} (wet weight) or 0.60 µg g^{-1} (dry weight).

These results are similar to those reported for Atlantic finfish (n ≥ 5) which had mean cadmium content ranging from 0.01 to 9.5 µg g^{-1} (dry weight) (Windom et al. 1973).

NICKEL RESULTS (Table 3)

Molluscs

Nickel levels for clams sampled ranged from 0.50 to 1.20 µg g^{-1} (wet weight) or 2.10 to 6.00 µg g^{-1} (dry weight).

Crustaceans

The mean nickel content of crustaceans was less than 0.50 µg g^{-1} (wet weight) or 2.20 µg g^{-1} (dry weight).

Fishes

In fish muscle tissue, the mean nickel levels ranged from 0.10 to 0.42 µg g^{-1} (wet weight) or 0.46 to 1.48 µg g^{-1} (dry weight).

IRON RESULTS (Table 5)

Molluscs

Molluscs were not analysed for iron content.

Crustaceans

In Dungeness crabs, *Cancer magister*, the iron content ranged from 4.0 to 11 μg g^{-1} (wet weight) or 29 to 76 μg g^{-1} (dry weight).

Fishes

Only one fish, a flounder, was analyzed to determine its iron content. It contained 24 μg g^{-1} (wet weight) or 100 μg g^{-1} (dry weight).

ARSENIC RESULTS (Table 5)

Molluscs

Only one Pacific oyster, *Crassostrea gigas*, was analyzed; its arsenic content was 1.7 μg g^{-1} (wet weight) or 6.7 μg g^{-1} (dry weight).

Crustaceans

The one red rock crab, *C. productus*, which was analyzed contained an arsenic concentration or 1.8 μg g^{-1} (wet weight) or 9 μg g^{-1} (dry weight).

Fishes

The arsenic content of fishes ranged from 0.3 μg g^{-1} in a coho salmon, *O. kisutch*, to 3.1 μg g^{-1} in a yelloweye rockfish, *Sebastes ruberrimus*, (wet weight) or 3.0 to 14 μg g^{-1} (dry weight) respectively.

The mean arsenic content of Atlantic finfish ($n > 5$) ranged from 1.1 to 2.5 μg g^{-1} (dry weight) (Windom et al. 1973).

RECOMMENDATIONS

The following organisms exhibited levels of metals that may be of concern and should be investigated further.

1. The mean mercury level (wet weight) of spiny dogfish, *Squalus acanthias*, was 1.01 ± 0.47 μg g^{-1} ($\bar{x}$ ± S.D., $n = 22$). The high mercury concentration in dogfish has been related to the size (length) and hence longevity of these fish.

2. The mean zinc level (wet weight) in the Pacific oyster, *Crassostrea gigas*, was 647 ± 927 μg g^{-1} ($\bar{x}$ ± S.D., $n = 46$). Although there was a great variability in the zinc content data, all of the 46 oysters tested exceeded 100 μg g^{-1} (wet weight).

3. Cadmium was concentrated by Pacific oysters, *C. gigas*, to a mean level (wet weight) of 1.37 ± 0.50 μg g^{-1} ($\bar{x}$ ± S.D., $n = 42$).

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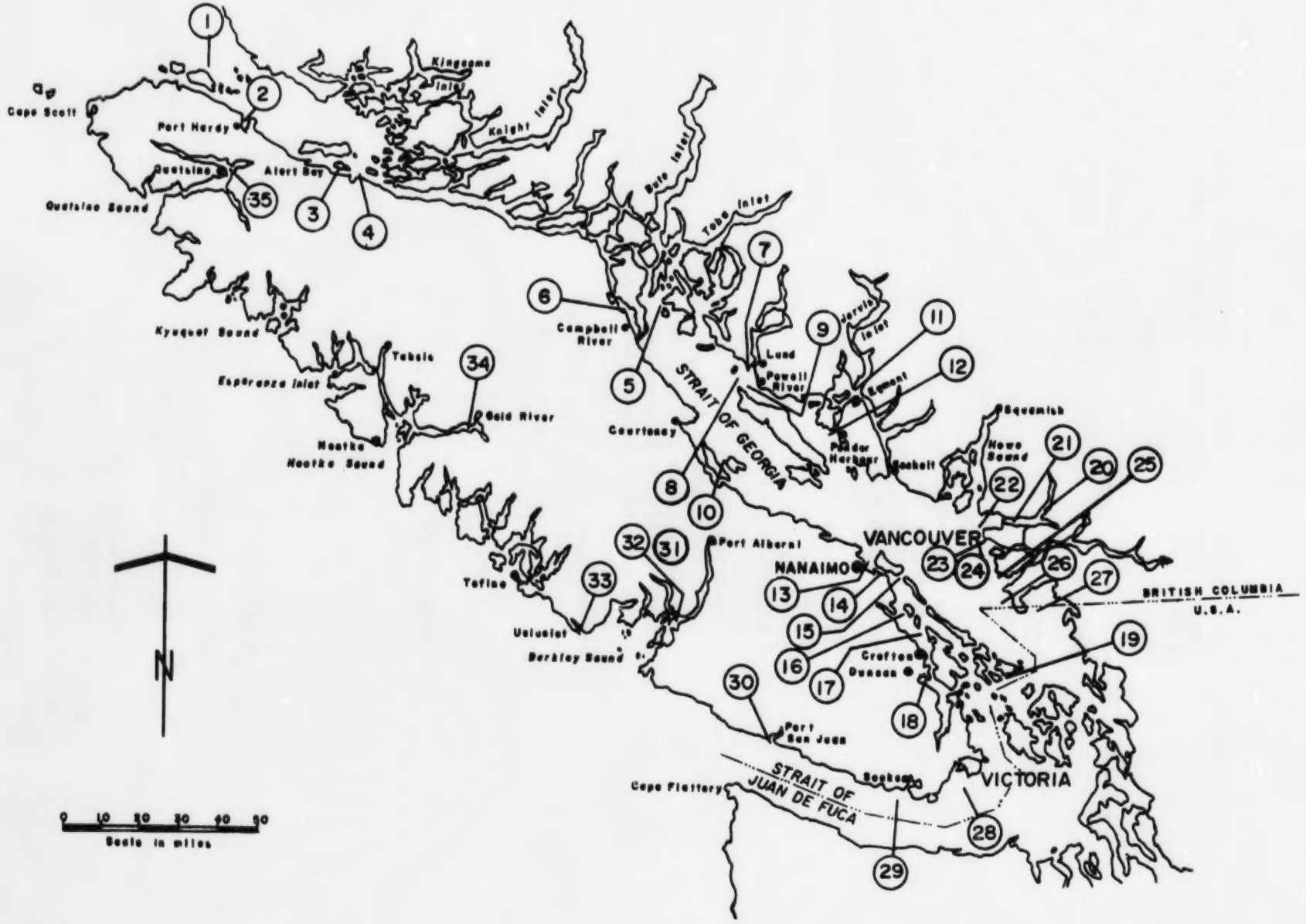

Figure 1 Sampling sites in coastal waters of southern British Columbia

TABLE 1. List of organisms analyzed for trace metals (major group headings according to Kozloff, 1974 and Hart, 1973)

MOLLUSCA

Class Amphipoda
chiton, unidentified
giant chiton, *Cryptochiton stelleri*

Class Gastropoda
limpet, unidentified
snail, unidentified
northern abalone, *Haliotis kamtschatkana*

Class Bivalvia
clam, unidentified
scallop, unidentified
butterclam, *Saxidomus giganteus*
littleneck clam, *Protothaca staminea*
horseclam, *Tresus capax*
Pacific oyster, *Crassostrea gigas*
cockle, *Clinocardium nuttalii*
blue mussels, *Mytilus edulis*
rock scallops, *Hinnites giganteus*

Class Cephalapoda
squid, unidentified
octopus, *Octopus dofleini*

ARTHROPODA

Class Crustacea
shrimp, unidentified
prawn, *Pandalus platyceros*
kelp crab, *Pugettia producta*
Dungeness crab, *Cancer magister*
red rock crab, *C. productus*

ECHINODERMATA

Class Holothuroidea
sea cucumber, unidentified
sea cucumber, *Parastichopus californicus*

Class Asteroidea
sea star, unidentified

Class Echinoidea
sea urchin, unidentified

CHORDATA

SUBPHYLUM UROCHORDATA
Class Ascideacea
tunicates, unidentified

SUBPHYLUM VERTEBRATA
Class Chondrichthys
spiny dogfish, *Squalus acanthias*
ratfish, *Hydrolagus colliei*

Class Osteichthys
Pacific herring, *Clupea harengus pallasi*
coho salmon, *Oncorhynchus kisutch*
chum salmon, *O. keta*
midshipman, *Porichthys notatus*
tube snout, *Aulorhynchus flavidus*
sea bass, *Cynoscian nobilis*
perch, unidentified
striped seaperch, *Embiotoca lateralis*
pile perch, *Rhacochilus vacca*
blenny, unidentified
wolf-eel, *Anarrichthys ocellatus*
rockfish, *Sebastes* sp.
yelloweye rockfish, *Sebastes ruberrimus*
copper rockfish, *S. caurinus*
black rockfish, *S. melanops*
boccacio, *S. paucispinis*
lingcod, *Ophiodon elongatus*
kelp greenling, *Hexagrammos decagrammus*
rock greenling, *H. lagocephalus*
sculpin, unidentified
buffalo sculpin, *Enophrys bison*
red Irish lord, *Hemilepidotus hemilepidotus*
flounder, unidentified
starry flounder, *Platichthys stellatus*

TABLE 2. Summary of mercury, copper and zinc levels in selected edible species.

Common Name (Species)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet Wt. $\bar{x} \pm$ S.D. (Range)	n	COPPER Wet Wt. $\bar{x} \pm$ S.D. (Range)	COPPER Dry Wt. $\bar{x} \pm$ S.D. (Range)	n	ZINC Wet Wt. $\bar{x} \pm$ S.D. (Range)	ZINC Dry Wt. $\bar{x} \pm$ S.D. (Range)
MOLLUSCS							
northern abalone *(Haliotis kamtschatkana)*	5	0.04 ± 0.01 (0.02 - 0.05)	5	4.12 ± 1.17 (2.70 - 5.60)	14.54 ± 3.42 (11.00 - 19.00)	5	10.18 ± 0.87 (8.90 - 11.00)	39.20 ± 2.95 (37.00 - 44.00)
blue mussels *(Mytilus edulis)*	5	0.07 ± 0.03 (0.04 - 0.13)	5	1.86 ± 0.55 (1.30 - 2.60)	11.20 ± 1.92 (8.00 - 13.00)	5	21.00 ± 9.85 (12.00 - 34.00)	121.20 ± 38.17 (76.00 - 170.00)
Pacific oysters *(Crassostrea gigas)*	58	0.07 ± 0.03 (0.02 - 0.15)	46	27.33 ± 45.94 (5.00 - 260.00)	122.24 ± 215.18 (21.00 - 1200.00)	46	646.74 ± 927.23 (150.00 - 5100.00)	2886.30 ± 4116.76 (620.00 - 22000.00)
littleneck clams *(Protothaca staminea)*	5	0.04 ± 0.03 (0.03 - 0.09)	5	2.70 ± 0.22 (2.50 - 3.00)	10.40 ± 1.09 (9.40 - 12.00)	5	13.40 ± 0.89 (12.00 - 14.00)	53.00 ± 3.24 (49.00 - 56.00)
horseclams *(Tresus capax)*	4	0.02 ± 0.01 (0.01 - 0.02)	1	3.30	17.00	1	8.40	43.00
butterclam *(Saxidomus giganteus)*	1	0.02	1	4.30	17.00	1	15.00	59.00
clams (aggregate)	6	0.06 ± 0.08 (0.02 - 0.23)	3	2.73 ± 2.07 (0.50 - 4.60)	12.07 ± 9.17 (2.30 - 20.50)	4	23.15 ± 7.06 (15.30 - 31.10)	104.90 ± 26.0 (79.10 - 133.80)
CRUSTACEANS								
red rock crab *(Cancer productus)*	36	0.12 ± 0.14 (0.02 - 0.65)	30	6.02 ± 2.70 (2.10 - 14.00)	29.98 ± 16.05 (14.00 - 96.00)	29	53.16 ± 9.73 (26.00 - 70.00)	252.59 ± 45.97 (190.00 - 360.00)
Dungeness crab *(Cancer magister)*	93	0.15 ± 0.11 (0.03 - 0.59)	70	8.59 ± 4.02 (0.95 - 23.00)	40.87 ± 17.37 (4.50 - 87.00)	70	40.35 ± 10.00 (3.90 - 67.00)	195.21 ± 51.56 (18.00 - 430.00)

two spotted prawn *(Pandalus platyceros)*	2	0.09 ± 0.03 (0.07 - 0.11)						
shrimp (aggregate)	7	0.08 ± 0.03 (0.05 - 0.15)	2	8.90 ± 5.80 (4.80 - 13.00)	38.00 ± 29.70 (17.00 - 59.00)	2	11.00 ± 0 (11.00)	44.50 ± 7.78 (39.00 - 50.00)
FISHES								
spiny dogfish *(Squalus acanthias)*	22	1.01 ± 0.47 (0.21 - 2.13)	16	0.61 ± 0.30 (0.30 - 1.40)	1.66 ± 0.78 (0.90 - 3.70)	15	5.83 ± 4.28 (2.40 - 16.00)	15.75 ± 11.31 (6.80 - 45.00)
Pacific herring *(Clupea harengus pallasi)*	4	0.07 ± 0.01 (0.06 - 0.09)	1	0.20	1.00	2	3.80 ± 0.71 (3.30 - 4.30)	16.45 ± 9.12 (10.00 - 22.90)
chum salmon *(Oncorhynchus keta)*	6	0.04 ± 0.02 (0.03 - 0.06)	6	0.75 ± 0.16 (0.50 - 1.00)	3.00 ± 0.63 (2.00 - 4.00)	6	3.55 ± 0.40 (3.10 - 4.30)	13.50 ± 1.52 (12.00 - 16.00)
coho salmon *(Oncorhynchus kisutch)*	11	0.04 ± 0.02 (0.02 - 0.10)	13	1.96 ± 1.92 (0.50 - 7.00)	7.65 ± 8.16 (2.00 - 31.00)	13	6.88 ± 5.20 (3.00 - 22.00)	25.15 ± 14.28 (12.00 - 55.00)
rockfishes *(Sebastes spp.)*	49	0.26 ± 0.26 (0.05 - 1.02)	34	0.57 ± 0.46 (0.20 - 2.10)	2.66 ± 2.16 (1.00 - 10.60)	40	5.03 ± 3.68 (2.30 - 19.00)	21.78 ± 15.22 (11.00 - 80.00)
kelp greenling *(Hexagrammos decagrammus)*	8	0.13 ± 0.11 (0.04 - 0.32)	8	0.46 ± 0.14 (0.40 - 0.80)	2.25 ± 0.71 (2.00 - 4.00)	8	4.44 ± 1.06 (3.20 - 5.90)	19.63 ± 3.70 (15.00 - 25.00)
lingcod *(Ophiodon elongatus)*	25	0.16 ± 0.13 (0.04 - 0.53)	15	0.59 ± 0.44 (0.28 - 2.00)	2.85 ± 2.12 (1.30 - 8.00)	17	12.45 ± 10.61 (1.30 - 41.00)	54.41 ± 46.64 (4.90 - 190.00)

TABLE 3. Summary of lead, cadmium and nickel levels in selected edible species.

Common Name (Species)	TRACE METALS ($\mu g\ g^{-1}$) LEAD n	Wet Wt. $\bar{x} \pm$ S.D. (Range)	Dry Wt. $\bar{x} \pm$ S.D. (Range)	CADMIUM n	Wet Wt. $\bar{x} \pm$ S.D. (Range)	Dry Wt. $\bar{x} \pm$ S.D. (Range)	NICKEL n	Wet Wt. $\bar{x} \pm$ S.D. (Range)	Dry Wt. $\bar{x} \pm$ S.D. (Range)
MOLLUSCS									
northern abalone *(Haliotis kamtschatkana)*	5	0.32 ± 0.14 (0.20 - 0.52)	1.39 ± 0.54 (1.00 - 2.00)	4	0.10 ± 0 (0.10)	0.50 ± 0 (0.50)			
blue mussels *(Mytilus edulis)*	4	0.65 ± 0.57 (0.20 - 1.40)	<1 4.25 ± 4.72 (1.00 - 11.00)	5	0.36 ± 0.11 (0.20 - 0.50)	2.28 ± 0.44 (2.00 - 3.00)			
Pacific oysters *(Crassostrea gigas)*	14	0.42 ± 0.20 (0.14 - 0.60)	1.97 ± 1.00 (0.66 - 3.00)	42	1.37 ± 0.50 (0.70 - 3.40)	5.95 ± 2.29 (2.90 - 14.00)			
littleneck clams *(Protothaca staminea)*	5	0.60 ± 0 (<0.60)	3.00 ± 0 (<3.00)	5	0.10 ± 0 (<0.10)	0.52 ± 0.05 (0.5 - 0.6)			
horseclams *(Tresus capax)*	1	0.15	0.80	1	0.06	<0.5 0.33	1	1.20	6.00
butterclams *(Saxidomus giganteus)*	1	0.20	0.80	1	0.06	0.30	1	0.80	3.50
clams (aggregate)	1	5.40	27.80				2	0.50 ± 0 (0.50)	2.20 ± 0.14 (2.10 - 2.30)
CRUSTACEANS									
red rock crab *(Cancer productus)*	25	0.25 ± 0.15 (0.09 - 0.60)	1.24 ± 0.71 (0.48 - 3.00)	23	0.11 ± 0.02 (0.10 - 0.20)	0.53 ± 0.11 (0.50 - 1.00)	6	0.42 ± 0.28 (0.13 - 0.90)	2.17 ± 1.87 (0.70 - 5.80)
Dungeness crab *(Cancer magister)*	29	0.37 ± 0.20 (0.05 - 0.80)	1.73 ± 1.00 (0.20 - 3.52)	50	0.10 ± 0.06 (0.03 - 0.50)	0.51 ± 0.25 (0.20 - 2.00)	11	0.33 ± 0.17 (0.20 - 0.70)	1.84 ± 1.40 (0.90 - 5.70)

shrimp (aggregate)	2	0.20 ± 0 (<0.20)	1.00 ± 0 (<1.00)	2	0.25 ± 0.21 (<0.10 – 0.40)	1.25 ± 1.06 (<0.50 – 2.00)		
FISHES								
spiny dogfish *(Squalus acanthias)*	9	0.32 ± 0.18 (<0.10 – 0.60)	0.97 ± 0.82 (0.31 – 3.00)	9	0.10 ± 0.06 (<0.04 – 0.20)	0.32 ± 0.18 (0.12 – 0.50)	3	0.42 ± 0.28 (0.10 – 0.62)	1.20 ± 0.78 (0.31 – 1.70)
Pacific herring *(Clupea harengus pallasi)*							1	0.50	2.10
chum salmon *(Oncorhynchus keta)*	6	0.23 ± 0.05 (<0.20 – 0.30)	1.00 ± 0 (<1.00)	6	0.10 ± 0 (<0.10)	0.50 ± 0 (<0.50)			
coho salmon *(Oncorhynchus kisutch)*	13	0.53 ± 0.16 (0.15 – 0.60)	2.43 ± 0.94 (<0.66 – 3.00)	13	0.12 ± 0.04 (<0.09 – 0.20)	0.51 ± 0.05 (<0.40 – 0.60)			
rockfishes *(Sebastes spp.)*	35	0.29 ± 0.18 (0.06 – 0.98)	1.32 ± 0.86 (<0.31 – 4.40)	31	0.09 ± 0.03 (<0.03 – 0.20)	0.44 ± 0.17 (<0.13 – 1.00)	8	0.36 ± 0.12 (0.06 – 0.45)	1.48 ± 0.48 (0.33 – 1.90)
kelp greenling *(Hexagrammos decagrammus)*	8	0.28 ± 0.15 (0.20 – 0.60)	1.75 ± 1.17 (1.00 – 4.00)	8	0.10 ± 0 (0.10)	0.50 ± 0 (0.50)			
lingcod *(Ophiodon elongatus)*	8	0.23 ± 0.21 (<0.07 – 0.60)	1.02 ± 0.98 (<0.33 – 3.00)	7	0.07 ± 0.07 (<0.02 – 0.20)	0.28 ± 0.20 (<0.10 – 0.50)	5	0.10 ± 0.06 (0.07 – 0.20)	0.46 ± 0.30 (0.32 – 1.00)

TABLE 4. Trace metal (Hg, Cu, Zn, Pb, Cd, Ni) data list for marine species.

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
1) Gordon Channel														
spiny dogfish *(Squalus acanthias)*	72 07			0.72										
spiny dogfish *(S. acanthias)*	72 07			1.74										
2) Port Hardy, Hardy Bay														
butterclam *(Saxidomus giganteus)*	71 05			0.02	4.3	17	15	59	0.2	0.8	0.06	0.3	0.8	3.5
Dungeness crab *(Cancer magister)*	71 03	M	19.7	0.14	7.2	28.1	59.6	234						
Dungeness crab *(C. magister)*	71 03	M	17.9	0.19	6.3	24.1	52.8	203.7						
Dungeness crab *(C. magister)*	71 03	M	15.8	0.25	6.7	25.6	56.4	217.5					0.2	0.9
Dungeness crab *(C. magister)*	71 03	M	16.1	0.05	6.8	38.0	38.4	216.0					0.2	1.3
Dungeness crab *(C. magister)*	71 03	M	15.8	0.04	8.2	32.7	52.6	208.4					0.2	0.9
Dungeness crab *(C. magister)*	71 11	M	18.7	0.15	6.4	27	53	230	0.3	1	0.04	0.2		
Dungeness crab *(C. magister)*	71 11	M	18.2	0.09	10	60	32	190	0.2	1	0.03	0.2	0.3	1.7
Dungeness crab *(C. magister)*	71 11	M	17.7	0.10	9.8	50	36	190	0.12	0.64	0.04	0.2		
Dungeness crab *(C. magister)*	71 11	M	18.2	0.13	0.95	4.5	3.9	18	0.3	1	0.04	0.2		
Dungeness crab *(C. magister)*	71 11	M	15.4	0.09	15	60	47	190	0.4	1.5	0.04	0.2	0.5	1.7
Dungeness Crab *(C. magister)*	71 11	M	15.9	0.07	8.5	37	48	210	0.05	0.2	0.5	2		
ratfish *(Hydrolagus colliei)*	71 03			0.26	0.2	1.3	4.2	23.0						

ratfish (*H. colliei*)	71 03		0.35	0.5	2.7	3.1	16.5					0.3	1.3
ratfish (*H. colliei*)	71 11	42	0.29	0.22	0.96	5.4	24	0.2	0.96	0.04	0.2	0.05	0.32
yelloweye rockfish[1] (*Sebastes ruberrimus*)	71 11	68	1.02			4.5	18	0.3	1	0.05	0.2	0.4	1.6
yelloweye rockfish[1] (*S. ruberrimus*)	71 11	68	0.84			4.7	17	0.2	1	0.05	0.2	0.4	1.6
rockfish (*Sebastes* sp.)	71 11	35	0.17	0.25	1.1	4.2	18	0.3	1	0.05	0.2	0.4	1.6
rockfish (*Sebastes* sp.)	71 11	35	0.18	0.35	1.4	4.7	19	0.2	1	0.05	0.2	0.4	1.6
3) Alert Bay, Broughton Strait													
giant chiton (*Cryptochiton stellsri*)	73 02		0.023	6.8	49	100	740	0.1	1	1.1	7.9		
northern abalone (*Haliotis kamtschatkana*)	73 02		0.044	5.6	19	11	37	< 0.3	< 1.0	<0.1	< 0.5		
rock scallop (*Hinnites giganteus*)	73 02		0.076	1	3	15	59	0.2	< 1.0	2.8	11		
blue mussel (*Mytilus edulis*)	73 02		0.066	2.2	13	29	170	0.2	1.0	0.4	2		
ratfish (*H. colliei*)	73 02		0.355	1	4	3.3	15	< 0.2	< 1.0	<0.1	< 0.5		
4) Kelsey Bay, Johnstone Strait													
rockfish (*Sebastes* sp.)	71 06	25	0.08	2	9	19	80						
kelp greenling (*Hexagrammos decagrammus*)	72 10	34	0.04	0.4	2	3.5	16	0.2	1	0.1	0.5		
kelp greenling (*H. decagrammus*)	72 10	32	0.04	0.4	2	3.5	17	0.2	1	0.1	0.5		
lingcod (*Ophiodon elongatus*)	71 06		0.06	0.36	1.6	14	63	0.09	0.42	0.03	0.13	0.07	0.32
lingcod (*O. elongatus*)	71 06		0.07	0.35	1.6	7.5	35	0.07	0.33	0.02	0.10	0.07	0.34
lingcod (*O. elongatus*)	71 06		0.12	0.35	1.5			0.07	0.33	0.03	0.13	0.07	0.32
lingcod (*O. elongatus*)	71 06		0.08	0.5	2	16	75						

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
5) Cortes Island														
Pacific oyster *(Crassostrea gigas)*	76 06			0.031										
Pacific oyster *(C. gigas)*	76 06			0.054										
Pacific oyster *(C. gigas)*	76 06			0.036										
Pacific oyster *(C. gigas)*	76 06			0.035										
Pacific oyster *(C. gigas)*	76 06			0.043										
Pacific oyster *(C. gigas)*	76 06			0.046										
Pacific oyster *(C. gigas)*	76 06			0.053										
Pacific oyster *(C. gigas)*	76 06			0.056										
Pacific oyster *(C. gigas)*	76 06			0.044										
Pacific oyster *(C. gigas)*	76 06			0.058										
6) Campbell River, Discovery Passage														
giant chiton *(C. stelleri)*	72 10			0.04	8.6	45	24	130	0.4	2	1.5	8.1		
rock scallop *(H. giganteus)*	72 10			0.05	0.5	2	20	75	0.3	1	2.9	11		
Pacific oyster *(C. gigas)*	71 06			0.04	210	1000	5100	22000						
Pacific oyster *(C. gigas)*	71 06				260	1200	4400	20000						
Pacific oyster *(C. gigas)*	72 10			0.05	16	76	490	2300	0.2	1	1.9	8.7		

red rock crab (*Cancer productus*)	72 10	14.5	0.04	6.8	30	59	270	0.2	1	0.1	0.5		
red rock crab (*C. productus*)	72 10	12.0	0.02	5.8	28	45	220	0.2	1	0.1	0.5		
red rock crab (*C. productus*)	72 10	13.0	0.05	6.9	28	58	240	0.2	1	0.1	0.5		
red rock crab (*C. productus*)	72 10	12.5	0.03										
red rock crab (*C. productus*)	72 10	13.5	0.03	4.5	23	43	220	0.2	1	0.2	1		
red rock crab (*C. productus*)	72 10	11.5	0.05	5.0	27	50	270	0.2	1	0.1	0.5		
spiny dogfish (*S. acanthias*)	71 06	70.5	0.21	1.4	3.7	13	35						
spiny dogfish (*S. acanthias*)	71 06	71.4		1	3	12	28						
spiny dogfish (*S. acanthias*)	71 06	60.2		0.8	2	16	45						
rockfish (*Sebastes sp.*)	71 06		0.30	0.33	1.6	7.9	39	0.06	0.31	0.03	0.13	0.06	0.33
rockfish (*Sebastes sp.*)	72 10	21.5	0.10	0.8	4	3.7	18	0.2	1	0.1	0.5		
rockfish (*Sebastes sp.*)	72 10	17.5	0.08	0.9	4	4.2	18	0.2	1	0.1	0.5		
lingcod (*O. elongatus*)	71 06		0.10	0.35	1.6	41	190	0.08	0.39	0.03	0.13	0.07	0.32
lingcod (*O. elongatus*)	71 06		0.09	2	8	25	110						
7) Lund													
Pacific oyster (*C. gigas*)	71 08		0.04										
wolf-eel (*Anarrhichthys ocellatus*)	71 08		0.04										
rockfish (*Sebastes sp.*)	71 08		0.11										
rockfish (*Sebastes sp.*)	71 08		0.10										
rockfish (*Sebastes sp.*)	71 08		0.07										

TABLE 4. continued

Site / Common Name (Species)	Date Yr	Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	COPPER Dry	ZINC Wet	ZINC Dry	LEAD Wet	LEAD Dry	CADMIUM Wet	CADMIUM Dry	NICKEL Wet	NICKEL Dry
rockfish (*Sebastes* sp.)	71	08			0.10										
rockfish (*Sebastes* sp.)	71	08			0.24										
8) Powell River, Harwood-Vivian Islands															
northern abalone (*H. kamtschatkana*)	72	10		12	0.05	3.2	14	10	44	0.4	2	0.1	0.5		
rock scallop (*H. giganteus*)	72	10		17.5	0.09	1	5	24	100	< 0.2	<1	3.6	15		
Pacific oyster (*C. gigas*)	72	10			0.10	34	150	1800	8000	< 0.2	<1	2.0	8.9		
red rock crab (*C. productus*)	72	10		12.5	0.05	7.8	39	52	260	< 0.3	<1	<0.1	< 0.5		
red rock crab (*C. productus*)	72	10		11.5	0.05	4.1	17	67	270	< 0.2	<1	0.1	0.5		
Dungeness crab (*C. magister*)	72	10		14.5	0.03	3.5	15	41	170	< 0.2	<1	<0.1	< 0.5		
spiny dogfish (*S. acanthias*)	72	10	F		1.37	0.8	2	3.0	6.8	< 0.4	<1	<0.1	< 0.5		
spiny dogfish (*S. acanthias*)	72	10	F		0.55	0.5	2	2.4	7.9	< 0.3	<1	<0.1	< 0.5		
striped seaperch (*Embiotoca lateralis*)	72	10		31	0.16	0.8	4	4.8	22	< 0.2	<1	<0.1	< 0.5		
striped seaperch (*E. lateralis*)	72	10		26	0.11	1.7	7.7	6.2	29	< 0.2	<1	0.2	0.8		
9) North Texada Island															
California seacucumber (*Parastichopus californicus*)	76	05			< 0.03										
California seacucumber (*P. californicus*)	76	05			0.03										
copper rockfish (*Sebastes caurinus*)	76	05		28	0.09										

lingcod (*O. elongatus*)	76 05	61.0	0.08										
lingcod (*O. elongatus*)	76 05	76.5	0.32										
lingcod (*O. elongatus*)	76 05	66.0	0.10										
lingcod (*O. elongatus*)	76 05	58.2	0.06										
lingcod (*O. elongatus*)	76 05	45.5	0.04										
10) Hornby Island, Strait of Georgia													
northern abalone (*H. kamtschatkana*)	72 10		0.04	2.7	11	8.9	37	<0.2	<1	<0.1	<0.5		
rock scallop (*H. giganteus*)	72 10		0.05	0.5	2	21	90	<0.2	<1	2.0	7.8		
Pacific oyster (*C. gigas*)	71 06		0.02										
Pacific oyster (*C. gigas*)	72 10		0.15	23	93	450	1800	0.6	2	1.4	5.6		
spiny dogfish (*S. acanthias*)	71 06		1.28	0.7	1.6			0.14	0.32	0.06	0.15		
spiny dogfish (*S. acanthias*)	71 06		1.16	0.5	1.5			0.10	0.31	0.04	0.12	0.10	0.31
sea bass (*Cynoscion nobilis*)	71 06		0.21	0.38	1.5	8.6	35	0.07	0.31			0.07	0.31
sea bass (*C. nobilis*)	71 06		0.34	0.39	1.6	6.6	27	0.08	0.33	0.05	0.20	0.08	0.32
rockfish (*Sebastes sp.*)	72 10	39.0	0.55	<0.4	2	3.8	19	<0.2	< 1	< 0.1	<0.5		
rockfish (*Sebastes sp.*)	72 10	27.0	0.10	0.6	3	3.7	18	0.2	1	< 0.1	<0.5		
kelp greenling (*H. decagrammus*)	72 10	35.0	0.05	0.5	2	4.9	19	<0.2	<1	< 0.1	<0.5		
lingcod (*O. elongatus*)	71 06		0.14			19	80						
lingcod (*O. elongatus*)	71 06		0.12	1	4	25	90						

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
11) Egmont														
Pacific oyster *(C. gigas)*	71 05			0.04	58	230	670	2700	0.22	0.91	3.4	14.0		
red rock crab *(C. productus)*	71 05			0.07	6.5	32.0	70	360	<0.09	< 0.48	<0.14	< 0.70	0.13	0.7
spiny dogfish *(S. acanthias)*	71 05			1.13	0.30	0.90	3.9	12.0	<0.10	<0.33	<0.06	< 0.19		
coho salmon *(Oncorhynchus kisutch)*	71 05				1.0	4.5	7.2	31.0	<0.15	<0.66	<0.09	< 0.40		
yelloweye rockfish *(S. ruberrimus)*	71 05			0.35	0.40	1.8	12.0	53.0	0.21	0.91	<0.09	< 0.40	0.45	1.9
rockfish *(Sebastes sp.)*	71 05			0.10	<1.7	<6.9	19	78	<0.28	<1.2	<0.08	< 0.35		
lingcod *(O. elongatus)*	71 05			0.35										
12) Pender Harbour, Malaspina Strait														
Pacific oyster *(C. gigas)*	72 10			0.04	28	150	530	2900	0.4	2	1.8	10		
Dungeness crab *(C. magister)*	72 10	M	16.5	0.07	6.2	41	30	200	0.2	1	<0.1	< 0.5		
Dungeness crab *(C. magister)*	72 10	M	17.0	0.12	4.6	29	25	160	0.2	1	<0.1	< 0.5		
Dungeness crab *(C. magister)*	72 10	M	17.0	0.11	5.3	36	28	190	0.3	2	<0.1	< 0.5		
Dungeness crab *(C. magister)*	72 10	M	14.5	0.13	7.7	34	37	160	0.4	2	<0.1	< 0.5		
chum salmon *(Oncorhynchus keta)*	72 10	M	176	0.03	0.8	3	3.5	13	<0.3	<1	<0.1	< 0.5		
chum salmon *(O. keta)*	72 10	M	171	0.06	0.5	2	3.4	12	<0.3	<1	<0.1	< 0.5		
chum salmon *(O. keta)*	72 10	M	169	0.05	0.7	3	3.5	14	<0.2	<1	<0.1	< 0.5		

chum salmon (*O. keta*)	72	10	M	174	0.03	0.7	3	3.1	12	<0.2	<1	<0.1	<0.5
chum salmon (*O. keta*)	72	10	M	168	0.03	0.8	3	3.5	14	<0.2	<1	<0.1	<0.5
chum salmon (*O. keta*)	72	10	M	171	0.06	1	4	4.3	16	<0.2	<1	<0.1	<0.5
13) Nanaimo Harbour													
Dungeness crab (*C. magister*)	72	10	M	15.5	0.14	8.2	41	39	200	0.6	3	0.1	0.5
Dungeness crab (*C. magister*)	72	10	M	15.5	0.06	5.8	36	28	170	0.6	3	0.1	0.5
14) Mudge Island, Gabriola Island													
littleneck clam (*Protothaca staminea*)	72	10			0.03	2.6	10	14	56	<0.6	<3	0.1	0.5
littleneck clam (*P. staminea*)	72	10			0.09	2.9	11	14	55	<0.6	<3	<0.1	<0.5
littleneck clam (*P. staminea*)	72	10			0.03	3.0	12	12	50	<0.6	<3	<0.1	<0.6
littleneck clam (*P. staminea*)	72	10			0.03	2.6	9.4	13	49	<0.6	<3	<0.1	<0.5
littleneck clam (*P. staminea*)	72	10			0.04	2.5	9.6	14	55	<0.6	<3	<0.1	<0.5
Pacific oyster (*C. gigas*)	72	10			0.11	8.9	38	230	1000	0.3	1	0.7	3
Pacific oyster (*C. gigas*)	72	10			0.05	9.3	38	310	1300	<0.6	<3	0.8	3
Pacific oyster (*C. gigas*)	72	10			0.06	6.6	25	380	1400	<0.6	<3	0.9	3
Pacific oyster (*C. gigas*)	72	10			0.06	5.0	21	160	660	<0.6	<3	1	4
Pacific oyster (*C. gigas*)	72	10			0.04	12	46	410	1600	<0.6	<3	1	4
Pacific oyster (*C. gigas*)	72	10			0.05	5.7	26	290	1300	<0.6	<3	0.7	3
Pacific oyster (*C. gigas*)	76	12			<0.08	18	83	400	1900			0.92	4.3
Pacific oyster (*C. gigas*)	76	12			<0.09	33	140	720	2900			1.5	6.0

TABLE 4. continued

Site Common Name (Species)	Date Yr	Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	COPPER Dry	ZINC Wet	ZINC Dry	LEAD Wet	LEAD Dry	CADMIUM Wet	CADMIUM Dry	NICKEL Wet	NICKEL Dry
Pacific oyster (*C. gigas*)	76	12			<0.09	12	54	250	1100			1.4	6.0		
Pacific oyster (*C. gigas*)	76	12			<0.10	20	79	320	1300			1.5	6.1		
Pacific oyster (*C. gigas*)	76	12			<0.09	22	88	510	2000			2.1	8.1		
Pacific oyster (*C. gigas*)	76	12			<0.10	24	95	480	1900			1.3	4.9		
Pacific oyster (*C. gigas*)	76	12			<0.08	14	66	220	1000			1.2	5.8		
Pacific oyster (*C. gigas*)	76	12			<0.10	19	80	380	1500			1.2	4.9		
Pacific oyster (*C. gigas*)	76	12			<0.09	24	100	500	2200			1.6	7.0		
Pacific oyster (*C. gigas*)	76	12			<0.07	16	78	350	1700			1.3	6.1		
Pacific oyster (*C. gigas*)	76	12			<0.09	7.9	30	210	810			1.3	4.8		
Pacific oyster (*C. gigas*)	76	12			<0.08	21	91	440	1900			2.2	9.9		
Pacific oyster (*C. gigas*)	76	12			<0.08	14	58	210	900			1.4	6.0		
Pacific oyster (*C. gigas*)	76	12			<0.07	14	61	550	2400			1.5	6.4		
Pacific oyster (*C. gigas*)	76	12			<0.08	13	61	240	1100			1.9	8.9		
Pacific oyster (*C. gigas*)	76	12			<0.08	15	72	500	2400			1.3	6.5		
Pacific oyster (*C. gigas*)	76	12			<0.07	20	86	380	1600			1.3	5.6		
Pacific oyster (*C. gigas*)	76	12			<0.06	12	64	420	2300			1.4	7.7		
Pacific oyster (*C. gigas*)	76	12			<0.10	18	72	280	1100			1.5	5.7		

Pacific oyster (*C. gigas*)	76 12			< 0.09	16	67	500	2100			1.1	4.6
Pacific oyster (*C. gigas*)	77 02			< 0.09	17	72	550	2300			1.4	6.0
Pacific oyster (*C. gigas*)	77 02			< 0.10	12	47	240	970			0.7	2.9
Pacific oyster (*C. gigas*)	77 02			< 0.08	7.6	32	150	620			0.79	3.3
Pacific oyster (*C. gigas*)	77 02			< 0.08	19	86	640	3000			1.8	8.5
Pacific oyster (*C. gigas*)	77 02			< 0.08	28	130	1000	4800			1.1	5.3
Pacific oyster (*C. gigas*)	77 02			< 0.09	18	73	790	3300			1.2	4.9
Pacific oyster (*C. gigas*)	77 02			< 0.09	18	77	220	910			0.97	4.1
Pacific oyster (*C. gigas*)	77 02			< 0.10	13	54	300	1200			1.1	4.4
Pacific oyster (*C. gigas*)	77 02			< 0.08	15	66	430	1800			1.3	5.5
Pacific oyster (*C. gigas*)	77 02			< 0.08	20	85	660	2900			1.1	4.9
15) Pylades Channel, Pirate Cove												
red rock crab (*C. productus*)	72 10	F	9.8	0.05								
red rock crab (*C. productus*)	72 10	M	12.0	0.06								
red rock crab (*C. productus*)	72 10	M	10.0	0.02								
red rock crab (*C. productus*)	72 10	M	13.4	0.06	4.8	19	62	250	< 0.6	< 3	< 0.1	< 0.5
kelp crab (*Pugettia producta*)	72 10	F	6.1	0.03								
kelp crab (*P. producta*)	72 10	M	5.6	0.05								
striped seaperch (*E. lateralis*)	72 10		24.6	0.04	0.9	4	5.8	29	< 0.6	< 3	< 0.1	< 0.5
striped seaperch (*E. lateralis*)	72 10		21.1	0.04	0.9	4	6.1	28	< 0.6	< 3	< 0.1	< 0.5
rockfish (*Sebastes sp.*)	72 10		32.6	0.14	0.7	3	5.3	23	< 0.6	< 3	< 0.1	< 0.5

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
rockfish *(Sebastes sp.)*	72 10		35.3	0.29	0.5	2	4.0	17	0.2	1	<0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		34.7	0.32	0.6	3	3.4	15	< 0.6	<3	<0.1	< 0.5		
kelp greenling *(H. decagrammus)*	72 10		32.8	0.18	0.8	4	5.9	25	0.4	2	<0.1	< 0.5		
lingcod *(O. elongatus)*	72 10		51.7	0.21	0.8	4	5.6	25	< 0.6	<3	<0.1	< 0.5		
lingcod *(O. elongatus)*	72 10		46.6	0.04	0.7	3	5.0	26	< 0.5	<2	<0.1	< 0.5		
16) Thetis Island, Stuart Channel														
Pacific oyster *(C. gigas)*	71 08			0.02	17	72	630	4800	0.15	1.0				
red rock crab[1] *(C. productus)*	71 08			0.04	3.0	17	41	230	< 0.12	< 0.66				
Dungeness crab *(C. magister)*	72 10	M	11.0	0.05	6.2	26	31	130	< 0.6	< 3	< 0.1	<0.5		
Dungeness crab *(C. magister)*	72 10	M	12.6	0.03	6.2	34	34	190	< 0.6	< 3	0.2	0.9		
Dungeness crab *(C. magister)*	72 10	F	11.7	0.08										
Dungeness crab *(C. magister)*	72 10	M	12.7	0.03	5.2	24	55	260	< 0.6	< 3	< 0.1	<0.5		
Dungeness crab *(C. magister)*	72 10	M	9.5	0.15										
Dungeness crab *(C. magister)*	72 10	M	12.1	0.04	7.3	40	42	230	< 0.6	< 3	< 0.1	<0.6		
Dungeness crab *(C. magister)*	72 10	M	9.8	0.05	5.6	22	39	150	< 0.6	< 3	< 0.1	<0.5		
spiny dogfish *(S. acanthias)*	71 08		95	2.13			3.9	11.5						
rockfish *(Sebastes sp.)*	71 08		30	0.25										

lingcod										
(O. elongatus)	71 08			0.53			4.9	22	<0.15	< 0.67
17) Chemainus - Crofton - Stuart Channel										
Pacific oyster										
(C. gigas)	71 04			0.03						
red rock crab										
(C. productus)	71 04	M	12.3	0.04						
red rock crab										
(C. productus)	72 01	M		0.12						
Dungeness crab										
(C. magister)	71 04	M	18	0.10						
Dungeness crab										
(C. magister)	72 01	M	16.5	0.03	7.8	38	41	200		
Dungeness crab										
(C. magister)	72 01	M	17.5	0.03						
octopus										
(Octopus dofleini)	72 01			0.01	4.4	20.5	11.8	54.8		
prawn										
(Pandalus platyceros)	71 04			0.11						
spiny dogfish										
(S. acanthias)	71 04			0.64						
spiny dogfish										
(S. acanthias)	71 04			0.61						
spiny dogfish										
(S. acanthias)	72 01		97	1.05	0.38	0.97	4.9	12		
spiny dogfish										
(S. acanthias)	72 01		70	0.21	0.48	1.3	4.8	15		
spiny dogfish										
(S. acanthias)	72 01		77		0.53	1.5	3.9	11		
spiny dogfish										
(S. acanthias)	72 01		85	0.78	0.35	1.0	6.7	16		
yelloweye rockfish										
(S. ruberrimus)	72 01		24	0.23	0.26	1.1	3.2	13		
yelloweye rockfish										
(S. ruberrimus)	72 01		35	0.22						
yelloweye rockfish										
(S. ruberrimus)	72 01		45	0.16	0.3	1.3	7.6	27		
rockfish										
(Sebastes sp.)	72 01		30	0.11	0.27	1.3	4.1	20		
lingcod										
(O. elongatus)	71 04			0.14						

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
lingcod *(O. elongatus)*	72 01		53	0.08	0.30	7.2	1.3	4.9						
lingcod *(O. elongatus)*	72 01		87	0.24	0.52	1.8	7.4	33						
lingcod *(O. elongatus)*	72 01		75.5	0.14	0.28	1.3	4.2	20						
lingcod *(O. elongatus)*	72 01		81.5	0.17	0.33	1.5	5.6	26						
lingcod *(O. elongatus)*	72 01		68.5	0.17	0.37	1.6	6.4	29						
18) Cowichan Bay														
Dungeness crab *(C. magister)*	72 10	M	18.5	0.04	6.2	26	35	150	0.3	1.0	0.1	0.5		
Dungeness crab *(C. magister)*	72 10	M	18.7	0.05										
Dungeness crab *(C. magister)*	72 10	M	17.9	0.11	7.3	33	38	170	0.6	3	0.1	0.5		
Dungeness crab *(C. magister)*	76 06	M	18	0.059										
Dungeness crab *(C. magister)*	76 06	M	19	0.052										
spiny dogfish *(S. acanthias)*	72 10		86.5	1.26	0.4	1	2.5	7.9	0.6	3	0.2	0.5		
spiny dogfish *(S. acanthias)*	72 10		89.5	1.41	0.8	2	2.8	7.2	0.3	0.8	0.2	0.5		
striped seaperch *(E. lateralis)*	72 10		30.8	0.15	0.3	2	3.9	18	0.3	1	0.1	0.5		
coho salmon *(O. kisutch)*	72 10		14.6	0.02	2.4	10	6.6	28	0.6	3	0.1	0.5		
coho salmon *(O. kisutch)*	72 10		16.3	0.02	7	31	5.4	24	0.2	0.9	0.1	0.5		
coho salmon *(O. kisutch)*	72 10		15.2	0.02	3.8	16	5.8	24	0.6	3	0.1	0.5		

coho salmon (*O. kisutch*)	72 10		15.2	0.02	1.6	7.7	5.4	26	0.6	3	0.1	0.6
coho salmon (*O. kisutch*)	72 10		13.6	0.03	1.3	5.6	13	55	0.6	3	0.2	0.6
coho salmon (*O. kisutch*)	72 10	F		0.05	4.1	9.7	22	53	0.6	1	0.2	0.5
coho salmon (*O. kisutch*)	72 10	M	78.3	0.10	0.7	2	3.8	14	0.6	3	0.1	0.5
coho salmon (*O. kisutch*)	72 10	M	74.3	0.03	0.8	3	5.3	19	< 0.6	< 3	< 0.1	< 0.5
coho salmon (*O. kisutch*)	72 10	F	61.5	0.04	0.7	2	3.9	12	< 0.6	< 3	< 0.2	< 0.5
coho salmon (*O. kisutch*)	72 10	F	61.9	0.02	0.8	3	4.5	15	< 0.5	< 2	< 0.1	< 0.5
coho salmon (*O. kisutch*)	72 10	F	71.3	0.04	0.8	3	3.5	13	< 0.6	< 3	0.1	0.5
lingcod (*O. elongatus*)	72 10		38.3	0.06	0.6	2	3.9	15	< 0.3	< 1	< 0.1	< 0.5
rockfish (*Sebastes sp.*)	72 10		32.9	0.07	0.4	2	2.7	12	0.3	1	< 0.1	< 0.5
rockfish (*Sebastes sp.*)	72 10		42.0	0.28	0.2	1	2.6	13	< 0.6	< 3	< 0.1	< 0.5
rockfish (*Sebastes sp.*)	72 10		34.0	0.05	0.3	1	3.3	14	< 0.2	< 0.9	< 0.1	< 0.5
19) Saturna Island, Haro Strait												
northern abalone (*H. kamtschatkana*)	71 09			0.02	4.4	11.7	10	38	0.52	1.97		
rock scallop (*H. gigantaus*)	71 09			0.03	0.16	0.59	19.5	72	< 0.17	< 0.66		
Pacific oyster (*C. gigas*)	71 09			0.03	20	91	560	2600	< 0.14	< 0.66		
Pacific oyster (*C. gigas*)	72 10			0.03	23	120	500	2500	< 0.6	< 3	1.5	7.5
kelp crab (*P. producta*)	72 10	M		0.03								
red rock crab (*C. productus*)	72 10	M	13.9	0.03	4.7	23	52	260	< 0.6	< 3	< 0.1	< 0.5
red rock crab (*C. productus*)	72 10	M	13.5	0.07	4.1	20	50	240	< 0.6	< 3	< 0.1	< 0.5
Dungeness crab (*C. magister*)	72 10	M	15.6	0.04	4.6	19	42	180	0.4	2	< 0.1	< 0.5

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
coho salmon *(O. kisutch)*	72 10				0.5	2	3.0	13	0.6	3	0.1	0.5		
copper rockfish *(S. caurinus)*	71 09		31.5	0.51	0.42	1.9	4.2	19	0.98	4.4				
copper rockfish *(S. caurinus)*	71 09		33	0.26	0.25	1.1	6.2	26	< 0.15	<0.67				
black rockfish *(Sebastes melanops)*	71 09		35	0.09			5.6	21	0.48	1.7				
black rockfish *(S. melanops)*	71 09		32	0.08			5.9	24	< 0.18	<0.8				
rockfish *(Sebastes sp.)*	72 10		33.8	0.08	0.4	2	3.3	14	0.3	1	<0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		31.8	0.25	0.3	1	3.6	17	< 0.6	<3	<0.1	< 0.5		
kelp greenling *(H. decagrammus)*	72 10		28.0	0.04	0.4	2	3.9	19	< 0.6	<3	<0.1	< 0.5		
20) Lower Indian Arm - Port Moody Arm - Vancouver Harbour														
blue mussel *(M. edulis)*	73 01			0.13	1.4	11	14	110	1.4	11	0.3	2.4		
red rock crab *(C. productus)*	71 02			0.04	14.0	59.5	46	195					0.2	1.0
red rock crab *(C. productus)*	71 02			0.04	4.8	41.3	46.5	196					0.5	1.9
red rock crab *(C. productus)*	71 02			0.13	7.0	36.3	57.4	299.2					0.5	2.3
red rock crab *(C. productus)*	71 02			0.13	6.4	35.7							0.3	1.3
Dungeness crab *(C. magister)*	71 02			0.07	8.0	45.3	49.4	276.6					0.2	1.3
Dungeness crab *(C. magister)*	71 02			0.07	7.9	43.7	51.9	291.5					0.3	1.5

Dungeness crab (*C. magister*)	71 02			0.13	7.0	32.8	45.5	212.6					0.2	1.1
Dungeness crab (*C. magister*)	71 02			0.13	7.7	35.8	48.5	226.9					0.3	1.2
spiny dogfish (*S. acanthias*)	71 02			1.11										
rockfish (*Sebastes sp.*)	73 01		45.5	0.98	0.3	1.4	2.3	11	0.3	1.3	< 0.2	< 1		
lingcod (*O. elongatus*)	71 02			0.49			19.8	81.1					0.2	1.0
22) Point Grey, Burrard Inlet														
octopus (*O. dofleini*)	73 01			0.04										
Dungeness crab (*C. magister*)	73 01	F	13.5	0.26	13	62	46	220			< 0.1	< 0.5		
Dungeness crab (*C. magister*)	73 01	M	16.0	0.26	3.1	24	35	210			< 0.1	< 0.5		
Dungeness crab (*C. magister*)	73 01	F	12.4	0.20	9.9	79	29	230			0.1	0.6		
Dungeness crab (*C. magister*)	73 01	F	12.9	0.13	9.3	50	36	190			< 0.1	< 0.5		
Dungeness crab (*C. magister*)	73 01	M	15.1	0.15	7.8	58	26	190			< 0.1	< 0.5		
midshipman (*Porichthys notatus*)	73 01			0.07										
starry flounder (*Platichthys stellatus*)	73 01		29.5	0.10										
23) Fraser River Estuary, North Arm Jetty														
sea bass (*C. nobilis*)	71 06				2	13	34	250						
24) Iona Island, Fraser River Estuary														
Dungeness crab (*C. magister*)	73 01	M	15.5	0.16										
starry flounder[1] (*P. stellatus*)	73 01			0.15										

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
25) Sturgeon Bay, Fraser River Estuary														
Dungeness crab *(C. magister)*	73 01		13	0.12										
Dungeness crab *(C. magister)*	73 01		14	0.42										
Dungeness crab *(C. magister)*	73 01		14	0.24										
Dungeness crab *(C. magister)*	73 01		15	0.33										
Dungeness crab *(C. magister)*	73 01		14	0.26										
Dungeness crab *(C. magister)*	73 01		13	0.11										
starry flounder *(P. stellatus)*	73 01			0.15										
26) Roberts Bank, Fraser River Estuary														
Dungeness crab *(C. magister)*	73 01	M	12.3	0.065	7.8	51	25	160	< 0.2	<1.0	<0.1	< 0.5		
Dungeness crab *(C. magister)*	73 01	F	12.0	0.059	9.5	45	40	190	< 0.2	<1.0	<0.1	< 0.5		
Dungeness crab *(C. magister)*	77 07		19.4	0.19	5.2	35	31	200			0.1	0.5		
Dungeness crab *(C. magister)*	77 07		17.1	0.27	8.0	35	32	140			0.1	0.5		
Dungeness crab *(C. magister)*	77 07		19.0	0.19	6.9	32	29	140			0.1	0.5		
Dungeness crab *(C. magister)*	77 07		16.5	0.35	11	50	39	180			0.1	0.5		
Dungeness crab *(C. magister)*	77 07		17.6	0.25	9.6	49	33	170			0.1	0.5		
Dungeness crab *(C. magister)*	77 07		16.0	0.33	12	75	25	160			0.1	0.5		

Dungeness crab (*C. magister*)	77 07		16.8	0.32	11	47	35	150			0.1	0.5
Dungeness crab (*C. magister*)	77 07		12.0		23	77	36	120			0.1	0.5
Dungeness crab (*C. magister*)	77 07		16.0	0.59	8.0	36	47	220			0.1	0.5
Dungeness crab (*C. magister*)	77 07		15.0	0.13	10	41	42	170			0.1	0.5
Dungeness crab (*C. magister*)	77 07		16.0	0.14	9.9	41	44	180			0.1	0.5
Dungeness crab (*C. magister*)	77 07		15.9	0.40	5.0	23	46	220			0.1	0.5
Dungeness crab (*C. magister*)	77 07		11.5		14	51	40	150			0.1	0.5
Dungeness crab (*C. magister*)	77 07		15.4	0.41	16	77	44	220			0.18	0.91
Dungeness crab (*C. magister*)	77 07		13.4	0.18	21	87	41	170			0.1	0.5
Dungeness crab (*C. magister*)	77 07		15.4	0.22	18	74	41	170			0.1	0.5
Dungeness crab (*C. magister*)	77 07		14.6	0.28	18	83	39	180			0.1	0.5
Dungeness crab (*C. magister*)	77 07		16.3	0.19	13	59	39	180			0.1	0.5
Dungeness crab (*C. magister*)	77 07		15.6	0.30	12	54	47	220			0.1	0.5
27) Crescent Beach, White Rock, Boundary Bay												
blue mussel (*M. edulis*)	73 01			0.039	1.8	12	16	100	0.2	1	0.2	2
cockle (*Clinocardium nuttalii*)	73 01			0.038	2.4	11	34	160	< 0.2	<1	< 0.1	< 0.5
kelp crab (*P. producta*)	73 01	F	6.5	0.037	1.8	12	16	100	0.2	1	0.2	2
kelp crab (*P. producta*)	73 01	F	6.5	0.036	4.5	31	32	220	< 0.5	<3	0.3	2
Dungeness crab (*C. magister*)	71 03			0.06								
Dungeness crab (*C. magister*)	71 10	M	17.9	0.17								

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
Dungeness crab *(C. magister)*	71 10	M	17.4	0.06										
Dungeness crab *(C. magister)*	71 10	M	17.2	0.15										
Dungeness crab *(C. magister)*	71 10	M	16.3	0.07	8.0	23	47	190						
Dungeness crab *(C. magister)*	71 10	M	15.9	0.08	9.2	33	49	200						
Dungeness crab *(C. magister)*	71 10	M	15.6	0.20	12	51	42	180						
Dungeness crab *(C. magister)*	71 10	M	16.1	0.05										
Dungeness crab *(C. magister)*	71 10	M	17.5	0.05										
Dungeness crab *(C. magister)*	71 10	M	15.2	0.15										
Dungeness crab *(C. magister)*	71 10	M	16.7	0.11										
Dungeness crab *(C. magister)*	73 01	F	9.5	0.068	5.8	23	35	140	<0.2	< 1.0	<0.1	<0.5		
Dungeness crab *(C. magister)*		M	16.0	0.189	7.4	32	37	160	0.3	1.0	0.1	<0.5		
spiny dogfish *(S. acanthias)*	71 10		18	0.97										
spiny dogfish *(S. acanthias)*	71 10		15	0.74										
spiny dogfish *(S. acanthias)*	71 10			0.67										
Pacific herring *(Clupea harengus pallasi)*	71 10			0.06										
tube-snout[1] *(Aulorhynchus flavidus)*	73 01			0.109	3.8	14	25	94	< 0.6	<2.0	<0.3	<1.0		
buffalo sculpin *(Enophrys bison)*	73 01		13.5	0.172	1.1	5.2	7.2	36	< 0.2	<1.0	<0.1	<0.5		

buffalo sculpin *(E. bison)*	73 01	13.5	0.039	1.7	8.1	7.6	36	< 0.2	<1.0	0.1	0.5		
sturgeon poacher[1] *(Agonus acipenserinus)*	73 01		0.04	3.8	15	15	59	0.3	1	<0.1	<0.5		
starry flounder *(P. stellatus)*	71 10		0.11										
starry flounder *(P. stellatus)*	71 10		0.06										
starry flounder *(P. stellatus)*	73 01		0.064	2.3	9.4	35	140	0.2	1	<0.1	< 0.5		
28) Victoria, Juan de Fuca Strait													
giant chiton *(C. stelleri)*	72 10		0.05	4.7	17	12	67			1.3	7.5		
northern abalone [1] *(H. kamtschatkana)*	72 10		0.03	4.7	17	11	40	< 0.2	<1	<0.1	< 0.5		
blue mussel *(M. edulis)*	72 10		0.07	2.6	12	34	150	0.8	4	0.4	2		
pile perch *(Rhacochilus vacca)*	72 10	28.4	0.11	0.4	2	3.8	18	< 0.2	<1	<0.1	< 0.5		
pile perch *(R. vacca)*	72 10	27.4	0.16										
rock greenling *(Hexagrammos lagocephalus)*	72 10	35.0	0.11	0.4	2	3.6	14	< 0.2	<1	<0.1	< 0.5		
rock greenling *(H. lagocephalus)*	72 10	37.4	0.07	0.5	2	4.1	17	< 0.2	<1	<0.1	< 0.5		
rock greenling *(H. lagocephalus)*	72 10	34.9	0.09	0.5	2	3.8	15	< 0.2	<1	<0.1	< 0.5		
red Irish lord *(Hemilepidotus hemilepidotus)*	72 10	27.2	0.17	32	140	45	190	0.4	2	2.6	12		
29) Sooke - Jordon River, Juan de Fuca Strait													
horse clam *(Tresus capax)*	71 09		0.02	3.3	17	8.4	43	0.15	0.8	0.06	0.33	1.2	6
horse clam *(T. capax)*	71 09		0.01										
horse clam *(T. capax)*	71 09		0.02										
30) Port Renfrew, Juan de Fuca Strait													
kelp greenling *(H. decagrammus)*	72 10	19.1	0.32	0.4	2	4.8	22	0.2	4	< 0.1	< 0.5		

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
31) Port Alberni, Sproat Narrows														
red rock crab *(C. productus)*	72 10	M	15.5	0.07	5.5	25	60	270	< 0.2	< 1.0	<0.1	< 0.5		
boccacio *(Sebastes paucispinis)*	72 10		48.0	0.15	0.4	2	3.4	15	0.2	1	<0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		32.0	0.21	0.4	2	3.1	15	< 0.2	< 1	<0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		32.0	0.17	0.4	2	3.6	17	< 0.2	< 1	<0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		43.0	0.12	0.6	3	3.6	16	< 0.2	< 1	<0.1	< 0.5		
32) Useless Inlet, Barkley Sound														
red rock crab *(C. productus)*	71 08	M		0.06	14	96	50	340	< 0.11	< 0.8				
Dungeness crab *(C. magister)*	71 08	F	18.2	0.23	8.0	51	67	430						
Dungeness crab *(C. magister)*	71 08	M	15.8	0.09	9.8	42	52	220						
Dungeness crab *(C. magister)*	71 08	M	15.7	0.13	7.8	31	43	170	< 0.19	< 0.66				
Dungeness crab *(C. magister)*	71 08	M	15.2	0.05	9.3	42	36	170	< 0.8	< 3.52				
Dungeness crab *(C. magister)*	71 08	M	14.9	0.05	4.2	16	59	220	< 0.16	< 0.65				
33) Ucluelet Inlet														
red rock crab *(C. productus)*	72 10		14.3	0.13	9.4	38	54	220	0.4	2	<0.1	< 0.5		
red rock crab *(C. productus)*	72 10		15.0	0.45	3.3	15	66	310	< 0.2	< 1	<0.1	< 0.5		
red rock crab *(C. productus)*	72 10		15.4	0.18	6.6	28	67	280	0.2	1	<0.1	< 0.5		

red rock crab *(C. productus)*	72	10		16.3	0.13	5.2	23	43	190	< 0.2	<1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		13.5	0.65	7.9	35	59	260	< 0.2	<1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		15.8	0.28	6.3	26	61	250	< 0.2	<1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		15.7	0.11	4.9	37	26	190	0.1	1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		14.9	0.16	3.8	16	58	250	< 0.2	<1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		14.6	0.37	6.9	36	41	220	< 0.2	<1	< 0.1	< 0.5
red rock crab *(C. productus)*	72	10		13.9	0.33	3.4	14	47	190	< 0.2	<1	< 0.1	< 0.5
striped seaperch *(E. lateralis)*	72	10		22.0	0.09	0.8	4	4.1	19	< 0.2	<1	< 0.1	< 0.5
rockfish *(Sebastes sp.)*	72	10		29.0	0.12	0.4	2	2.8	13	< 0.2	<1	< 0.1	< 0.5
kelp greenling *(H. decagrammus)*	72	10		22.2	0.25	0.4	2	3.2	15	< 0.2	<1	< 0.1	< 0.5
kelp greenling *(H. decagrammus)*	72	10		25.2	0.10	0.4	2	5.8	24	0.2	1	0.1	0.5
34) Gold River, Muchalet Inlet													
rock scallop[1] *(H. giganteus)*	72	10			0.05	0.4	2	22	96	0.2	1	2.9	13
blue mussel *(M. edulis)*	72	10			0.06	1.3	8.0	12	76			0.5	3
prawn *(P. platyceros)*	71	04			0.07								
red rock crab *(C. productus)*	72	10		14.5	0.12	5.1	20	58	230	< 0.2	<1	< 0.1	< 0.5
Dungeness crab *(C. magister)*	71	04	M	18.6	0.07								
striped seaperch *(E. lateralis)*	72	10		24	0.10	0.8	4	6.1	27	< 0.2	<1	< 0.1	< 0.5
boccacio *(S. paucispinis)*	72	10		36.5	0.09	0.6	3	3.4	16	< 0.2	<1	< 0.1	< 0.5
boccacio *(S. paucispinis)*	72	10		34.5	0.09	0.6	3	3.5	16	< 0.2	<1	< 0.1	< 0.5

TABLE 4. continued

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	Dry	ZINC Wet	Dry	LEAD Wet	Dry	CADMIUM Wet	Dry	NICKEL Wet	Dry
rockfish *(Sebastes sp.)*	72 10		28	0.4	0.4	2	3.2	14	< 0.2	< 1	< 0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		28	0.39	0.6	3	3.8	19	< 0.2	< 1	< 0.1	< 0.5		
rockfish *(Sebastes sp.)*	72 10		22	0.31										
35) Coal Harbour, Holberg Inlet														
horse clam *(T. capax)*	71 10			0.02										
red rock crab *(C. productus)*	71 03	M		0.05	2.1	14.5	52.6	344.8					0.9	5.8
Dungeness crab *(C. magister)*	71 03	F	18.1	0.12	3.2	24.9	35.9	284.6					0.7	5.7
Dungeness crab *(C. magister)*	71 03	F	17.0	0.25	3.8	24.3	49.4	315.0					0.5	2.9
Dungeness crab *(C. magister)*	71 03	M	16.4	0.23										
Dungeness crab *(C. magister)*	71 11	M	16.8	0.12	6.8	34	45	230	0.5	2	0.03	0.2		
Dungeness crab *(C. magister)*	71 04			0.23										
spiny dogfish *(S. acanthias)*	71 10	M		1.39	0.38	0.96	3.1	7.9	0.5	1	0.07	0.2	0.62	1.6
spiny dogfish *(S. acanthias)*	71 03	M		1.18	0.38	1.2	4.5	13	0.4	1	0.07	0.2	0.55	1.7
Pacific herring *(C. harengus pallasi)*	71 03						3.3	10.0						
Pacific herring *(C. harengus pallasi)*	71 03				0.2	1.0	4.3	22.9					0.5	2.1
Pacific herring *(C. harengus pallasi)*	71 03			0.06										
Pacific herring *(C. harengus pallasi)*	71 03			0.07										

Pacific herring *(C. harengus pallasi)*	71 03	0.09				
rockfish *(Sebastes sp.)*	71 03	0.06	2.1	10.6	2.8	14.1

[1]Aggregate sample

TABLE 5. Arsenic and Iron data list for marine species.

Site Common Name (Species)	Date Yr Mo	Sex	Length (cm)	TRACE METALS (ug g^{-1}) ARSENIC Wet	 Dry	 IRON Wet	 Dry
11 Egmont							
Pacific oyster *(C. gigas)*	71 05			1.7	6.7		
red rock crab *(C. productus)*	71 05			1.8	9		
spiny dogfish *(S. acanthias)*	71 05			2.1	6.5		
coho salmon *(O. kisutch)*	71 05			0.3	3.0		
yelloweye rockfish *(S. ruberrimus)*	71 05			3.1	14		
rockfish *(Sebastes sp.)*	71 05				10		
lingcod *(O. elongatus)*	71 05				10		
12 Point Grey, Burrard Inlet							
Dungeness crab *(C. magister)*	73 01	F	13.5			11	49
Dungeness crab *(C. magister)*	73 01	M	16.0			4.3	33
Dungeness crab *(C. magister)*	73 01	F	12.4			9.5	76
Dungeness crab *(C. magister)*	73 01	F	12.9			9.3	48
Dungeness crab *(C. magister)*	73 01	M	15.1			4.0	29
flounder	73 01					24	100

TABLE 6. Trace metal (Hg, Cu, Zn, Pb, Cd, Ni) data list for marine organisms (not identified to species level).

Site Common Name	DATE Yr Mo	Sex	LENGTH (cm)	MERCURY Wet	COPPER Wet	COPPER Dry	ZINC Wet	ZINC Dry	LEAD Wet	LEAD Dry	CADMIUM Wet	CADMIUM Dry	NICKEL Wet	NICKEL Dry
2) Port Hardy, Hardy Bay														
clam	71 03			0.02										
clam	71 03			0.03									0.5	2.3
clam	71 03				0.5	2.3	19.6	87.2						
clam[1]	71 03			0.03			15.3	79.1	5.4	27.8			0.5	2.1
clam	71 03			0.23	3.1	13.4	31.1	133.8						
clam[1]	71 03			0.04	4.6	20.5	26.6	119.5						
sculpin	71 03			0.14	1.3	6.7	2.8	14.4						
sculpin	71 03				2.6	14.0	6.5	34.9						
sculpin	71 03			0.07										
3) Alert Bay, Broughton Strait														
chiton	73 02			0.039	4.7	29	12	72	1.0	8	1.9	12		
whelk	73 02			0.096	17	74	60	250	< 0.2	< 1.0	0.9	4		
8) Powell River, Harwood - Vivian Islands														
chiton	72 10			0.09	8.3	47	16	91			1.8	10		
10) Hornby Island, Strait of Georgia														
limpet	72 10			0.03										
clam	71 06			0.02										
12) Pender Harbour, Malaspina Strait														
sea star	72 10			0.06	15	70	29	130	2.3	11	1.4	6.4		
sea cucumber	72 10				2.2	11	15	75	< 0.1	< 1	< 0.1	< 0.5		
flounder	72 10		40.5	0.11	0.8	4	3.2	15	< 0.2	< 1	< 0.1	< 0.5		
15) Pylades Channel, Pirate Cove														
periwinkle	72 10			0.08										
17) Chemainus - Crofton, Stuart Channel														
squid	71 04			0.16										
shrimp	71 04			0.06										
flounder	72 01		30	0.08	0.40	1.35	7.0	23						

Table 6. continued

Site / Common Name	Date Yr Mo	Sex	Length (cm)	TRACE METALS ($\mu g\ g^{-1}$) MERCURY Wet	COPPER Wet	COPPER Dry	ZINC Wet	ZINC Dry	LEAD Wet	LEAD Dry	CADMIUM Wet	CADMIUM Dry	NICKEL Wet	NICKEL Dry
flounder	72 01		28.5	0.05	0.34	1.0	7.1	22						
flounder	72 01		20	0.03	0.27	1.1	5.4	21						
19) Saturna Island, Haro Strait														
chiton				0.04										
periwinkle				0.04										
sculpin	71 09		47	0.28	0.25	1.1	4.3	19	<0.14	<0.65				
20) Lower Indian Arm, Port Moody Arm, Vancouver Harbour														
whelk	73 01			0.21	16	71	200	910	0.5	2.1	6.6	30		
sea star	73 01			0.05	2.1	10	35	160	3.8	18	0.3	1.5		
sea cucumber	73 01			0.13	0.6	14	4.0	86	2.2	48	0.06	1.3		
sculpin	71 02		29.3	0.27	1.1	4.9	3.5	16	<0.2	< 1	<0.2	< 1		
flounder	73 01		29.4	0.31	0.7	3.0	7.4	32	0.8	3.6	<0.2	< 1		
21) Brockton Point, Burrard Inlet														
chiton[1]	73 01			0.08	19	130	14	98	<0.3	<2	0.6	1.4		
whelk	73 01			0.10	1.4	7.2	19	99	<1	<6	0.7	3.4		
sea urchin[1]	73 01			0.10	0.7	6.9	3.9	41	0.4	3.9	0.2	2.0		
sea cucumber	73 01			0.08	0.5	7.6	5.7	89	0.7	11	0.1	1.8		
sculpin	73 01		29.0	0.13	0.4	1.7	4.7	22	0.2	1.1	<0.2	< 1		
flounder	73 01		33.0	0.11	0.8	3.8	3.4	15	<0.2	< 1	<0.2	< 1		
22) Point Grey, Burrard Inlet														
scallop	73 01			0.12										
shrimp[1]	73 01			0.07										
blenny	73 01			0.07										
flounder[1]	73 01			0.09	2.2	9.2	15	63			<0.1	< 0.5		
flounder[1]	73 01			0.16										
23) Fraser River Estuary, North Arm Jetty														
sculpin	71 06				1	7	20	110						
flounder	71 06		25.5	0.32										

24) Iona Island											
shrimp[1]	73 01		0.06								
flounder[1]	73 01		0.08								
25) Sturgeon Bank, Fraser River Estuary											
snail	73 01		0.09								
shrimp	73 01		0.07								
flounder[1]	73 01		0.09								
26) Roberts Bank, Fraser River Estuary											
shrimp[1]	73 01		0.052	13	59	11	50	<0.2	<1	0.4	2
flounder[1]	73 01		0.11	36	17	15	70	0.2	1	< 0.1	< 0.5
27) Crescent Beach, White Rock, Boundary Bay											
chiton	73 01		0.047	35	150	24	100	0.8	3	3.7	16
shrimp	73 01		0.153								
sea star	71 01		0.12								
tunicates	73 01		0.036	5.5	27	11	56	0.5	2	7.3	36
sculpin	71 03		0.07								
sculpin	71 03		0.17								
sculpin	71 03		0.07								
sculpin	71 10		0.10								
sculpin	73 01	7.6	0.078	3.2	14	13	58	<0.5	<2	< 0.3	< 1
flounder[1]	71 03		0.02								
flounder	73 01		0.077	2.1	9.7	11	48	<0.2	<1.0	< 0.1	< 0.5
28) Victoria, Juan de Fuca Strait											
whelk[1]	72 10		0.22								
sea urchin[1]	72 10		0.01	0.5	6.9	2.6	36	0.1	1	<0.1	< 1
sea cucumber	72 10		0.05	0.5	5.1	5.1	55	0.1	1	<0.04	< 0.4
30) Port Renfrew, Juan de Fuca Strait											
whelk	72 10		0.03								
limpit	72 10		0.04	3.7	18	14	70	0.3	2	1.3	6.3
31) Port Alberni, Sproat Narrows											
sea urchin	72 10		0.05	1.1	10	30	270	0.5	5	<0.1	< 0.5
sea cucumber	72 10		0.05								

Table 6. continued

Site / Common Name	Date Yr	Mo	Sex	Length (cm)	TRACE METALS (ug g^{-1}) MERCURY Wet	COPPER Wet	COPPER Dry	ZINC Wet	ZINC Dry	LEAD Wet	LEAD Dry	CADMIUM Wet	CADMIUM Dry	NICKEL Wet	NICKEL Dry
33) Ucluelet Inlet															
turban snail	72	10			0.19	15	59	38	150	0.2	1	0.2	< 0.6		
shrimp[1]	72	10			0.08	4.8	17	11	39	<0.2	<1	<0.1	< 0.5		
34) Golden River															
turban snail	72	10			0.004	13	52	28	110	<0.2	<1	0.4	2		
35) Coal Harbour, Holberg Inlet															
perch	71	03			0.04										
sculpin	71	03			0.09	0.8	4.4	7.0	40.9						
sculpin	71	03			0.11										
sculpin	71	03			0.03			6.1	28.4						

[1] aggregate sample